

*VERBAL MEDIATING RESPONSES: EFFECTS ON GENERALIZATION  
OF SAY-DO CORRESPONDENCE AND NONCORRESPONDENCE*

EDHEN LAURA LIMA AND JOSELE ABREU-RODRIGUES

UNIVERSIDADE DE BRASÍLIA, BRAZIL

We analyzed the effects of verbal mediating responses on the acquisition and generalization of say–do correspondence and noncorrespondence. Participants were assigned to groups in which either reinforcers (feedback and tokens) were arranged for say–do correspondence and noncorrespondence, or no reinforcers were programmed. Participants in these groups were further subdivided into groups in which they were required to repeat what was said previously, were required to repeat random numbers, or no verbalizations were required. When correspondence was reinforced, repetition of what was said produced greater acquisition and generalization of correspondence. When noncorrespondence was reinforced, repetition of numbers facilitated acquisition and generalization of noncorrespondence. Verbal mediating responses interacted with contingencies of reinforcement in determining acquisition and generalization of correspondence and noncorrespondence.

*Key words:* generalization, noncorrespondence, say–do correspondence, verbal mediating responses

Correspondence between verbal and nonverbal behavior is defined as a relation between what a person says and does or between what a person does and then reports. In both basic and applied studies, the establishment of the say–do relation is investigated by way of correspondence training. The procedures involved in correspondence training were reported initially by Risley and Hart (1968) and have been investigated by several researchers more recently (e.g., Baer, 1990; Beckert, 2005; Bevill-Davis, Clees, & Gast, 2004; Lloyd, 2002; Paniagua, 1990). In its most basic form, correspondence training involves two behavioral sequences: say–do and do–say. In say–do sequences, the

participant initially verbalizes his or her future nonverbal behavior and receives reinforcers for emitting that behavior at a later time (e.g., Baer, Detrich, & Weninger, 1988; Baer, Williams, Osnes, & Stokes, 1984). In do–say sequences, the participant emits nonverbal behavior and receives reinforcers for reporting that behavior at a later time (e.g., de Freitas Ribeiro, 1989; Israel, 1973; Paniagua & Baer, 1982). When these two procedures are directly compared, say–do training is more effective in producing correspondence (e.g., Israel & O’Leary, 1973; Karoly & Dirks, 1977). To account for the differential effectiveness of say–do training, Israel and O’Leary suggested that the verbal component is a discriminative stimulus more readily available and versatile than nonverbal behavior, although the initial behavior in both types of correspondence entails discriminative functions.

The effectiveness of the training procedures has been assessed in terms of generalization. Generalization of correspondence involves the occurrence of correspondence when untrained behavioral sequences are taken into account or the occurrence of the trained correspondence sequence in new settings. Luciano, Herruzo, and Barnes-Holmes (2001) assessed generalization of say–do correspondence with 3- to 5-year-old

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Correspondence should be addressed to the second author at the Universidade de Brasília, Campus Universitário Darcy Ribeiro, Instituto de Psicologia, Departamento de Processos Psicológicos Básicos, Brasília, Distrito Federal, 70910-900 Brazil (e-mail: abreu@unb.br).

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children during three conditions: baseline, correspondence training, and generalization. For all conditions, the sequence of events was as follows: The experimenter asked the child what he or she was going to do in a second room, the child stated his or her future behavior, the experimenter accompanied the child to the other room, the child had the opportunity to play for 1 min, and then the experimenter took the child back to the first room. During baseline, there were no programmed consequences for say-do correspondence, and four target responses were measured: touching a figure, placing a pencil onto a shelf, putting an object on a table, and opening one door. During correspondence training, the target behavior was touching one of three figures located on the top, middle, or bottom of a piece of paper. Five children were required to verbally state what they would do (verbal group). For the remaining six children, there was no requirement for verbalizations. Rather, they were required to place an arbitrary sticker on the top, middle, or bottom of a piece of paper (symbolic group). For instance, if the child intended to touch the figure at the top, the child was supposed to place the sticker at the top of the paper. For both groups, reinforcers were delivered contingent on say-do correspondence. During generalization tests, verbal behavior (for the verbal group) and symbolic behavior (for the symbolic group) were still in place, and correspondence was assessed for the remaining three responses (placing a pencil on a shelf, putting an object on a table, and opening one door). Results indicated that children in the symbolic group were more likely to generalize correspondence than those in the verbal group. Luciano et al. suggested that the sticker was more effective because it was available during the delay between saying and doing, allowing the child to consult it during that period. This mediating behavior (consulting or attending to the sticker) strengthened control of what was said, thus facilitating the emission of correspondent doing.

The facilitative function of mediating responses was analyzed by Taylor and O'Reilly

(1997). The researchers used a self-instructional procedure, in which the only programmed consequence for doing was delivered by the participant him- or herself (e.g., the child said "well done" to him- or herself) instead of a procedure in which the experimenter stated the reinforcement contingency explicitly (e.g., "You said you were going to do X, and you really did it; because of that, you will get a token"). More specifically, the experimenter taught participants with mild intellectual disabilities shopping skills while overtly or covertly verbalizing (and self-acknowledging) the steps of the task. Those verbalizations improved performance as compared to baseline levels. In the blocking condition, instead of verbalizing the steps of the task, participants were required to verbalize random numbers under overt and covert conditions. The authors suggested that repetition of random numbers disrupted target behavior during the blocking condition and during generalization tests. The results from the blocking condition indicated that (a) shopping skills in the self-instructional training were under the antecedent control of overt and covert verbalizations, and (b) the content of mediating responses differentially affected subsequent behavior. In particular, verbal behavior consistent with subsequent nonverbal behavior appeared to facilitate acquisition and generalization, and verbal behavior that was unrelated to subsequent nonverbal behavior impaired both acquisition and generalization.

The results reported by Luciano et al. (2001) and Taylor and O'Reilly (1997) suggest that mediating responses may be controlling variables in correspondence training. However, procedural aspects make it difficult to evaluate the impact of those variables. Luciano et al. did not clearly demonstrate whether the generalization exhibited by children in the symbolic group, in contrast to the verbal group, was due to the possibility of consulting the stimulus (sticker) between saying and doing, the similarity between the sticker's content and the

doing, or both. This may be important, because Taylor and O'Reilly demonstrated that continuous repetition of verbal mediating responses promoted acquisition and generalization, but this effect was observed only when its content was task related. However, unlike Luciano et al., Taylor and O'Reilly used a self-instructional procedure rather than the standard correspondence procedure (i.e., experimenter-delivered instructions) used in most other investigations. In addition, different populations were involved in these studies, and the absence of control conditions prevents unambiguous conclusions.

One other underexplored area is noncorrespondence, which is a discrepancy between verbal and nonverbal behavior. One of the few studies on noncorrespondence was conducted by Amorim and Andery (2002) with 12-year-old participants. When reinforcers were contingent on do-say relations, high levels of correspondence were observed; when reinforcers were contingent on the absence of do-say correspondence, noncorrespondence was obtained.

To extend previous findings, the present study evaluated the controlling properties of mediating responses on acquisition and generalization of say-do correspondence. Typically developing children were exposed to either the standard say-do correspondence training or to control conditions in which no reinforcers were delivered for correspondence (or noncorrespondence). Correspondence and control groups were subdivided into groups that differed with regard to the content of verbalizations between verbal behavior (saying) and nonverbal behavior (doing): a continuous repetition of what was said (task-related verbalization), a continuous repetition of a random sequence of numbers (task-unrelated verbalization), or no verbalization. After training, generalization tests were conducted.

Another goal of the present study was to assess the effects of mediating responses on acquisition and generalization of noncorrespondence. Given that both correspondence and

noncorrespondence are established by reinforcement contingencies and that verbal mediating responses affect acquisition and generalization of correspondence (Luciano et al., 2001; Taylor & O'Reilly, 1997), a question that follows is whether the same would occur with regard to noncorrespondence. To answer this latter question, children in the present study were exposed to say-do noncorrespondence training, during which they were required to repeat what they said they would do (before the opportunity to engage in any of the responses) or to repeat a random sequence of numbers between what they said they would do and the opportunity to engage in any of the responses, or there were no requirements for verbalizations.

## METHOD

### *Participants*

Thirty typically developing 3- to 5-year-old children, 15 boys and 15 girls with no previous experience with the experimental procedures, participated in this study. The experiment was approved by a Brazilian research ethics committee, and informed consent was obtained for each child before beginning the study.

### *Settings and Materials*

Sessions were conducted 5 days per week in two unoccupied kindergarten classrooms: the say room and the do room. In the say room, the experimenter used a puppet to ask questions, provide feedback, and deliver tokens. Several toys were available in the do room; however, only a subset of those toys, identified as Stimulus Sets A (a plastic hammer, a die, a plastic car), B (three books), and C (three musical instruments), were of interest for the present experiment. Participants could play with any toy during all conditions. Yellow cards were used as tokens, which could be exchanged at the end of each session for candies, stickers, and toys from a small store placed in the say room. To establish tokens as reinforcers, the experimenter gave each child 10 tokens and

instructed the child to use the tokens to buy preferred items or to keep them. Because all children elected to spend their tokens, it was assumed that the tokens were generalized conditioned reinforcers and that at least some subset of stimuli available from the store functioned as effective backup reinforcers.

### *Dependent Variables*

Data collectors scored what each participant said he or she would do (i.e., the toy the child selected), what he or she did (i.e., the toy with which the child played), and whether or not the experimenter delivered reinforcers. Correspondence was defined as playing exclusively with the toy previously indicated by the child. Noncorrespondence was defined as playing with toys other than the one specified by the child or not playing exclusively with the chosen toy. Observers scored verbal and nonverbal behavior on paper data sheets during sessions, and all sessions were videotaped.

### *Procedure*

All participants were exposed to three conditions (baseline, training, and generalization), but only one condition occurred per day.

**Baseline.** This condition was identical for all participants and consisted of nine trials, three for each stimulus set. Each trial was initiated and finalized in the say room. In other words, all participants began the trial in the say room, proceeded to the do room, and returned to the say room. In the say room, a puppet asked the participant with which toy he or she was going to play. For the first three trials, the puppet asked participants the following question concerning Stimulus Set A: "There are three toys in the other room: a plastic hammer, a die, and a car. You should choose one of them to play with. Which one are you going to choose?" During the next three trials, participants were asked about Stimulus Set B: "There are three books in the other room: *Alice's Adventures in Wonderland*, *The Golden Duck*, and *Little Red Riding Hood*. You should choose one of them.

Which one are you going to choose?" During the final three trials, questions were related to Stimulus Set C: "There are three musical instruments in the other room: a guitar, a tambourine, and a pipe. You should choose one of them to play with. Which one are you going to choose?" After each participant verbally indicated the item with which he or she wanted to play, the puppet informed the participant that the experimenter was coming to take him or her to the other room. In the do room, which contained the stimulus set (A, B, or C) related to the question in addition to other toys, the child was allowed to play for 2 min, and the observer scored the items with which the child interacted. There was no feedback or token delivery for either saying or doing or for say-do correspondence during baseline. Following the 2-min play period, the experimenter escorted the child back to the say room and initiated the next trial.

After baseline, the participants were assigned to 1 of 10 groups, comprised of three children each, based on levels of correspondence during baseline. Five groups contained participants with baseline levels of correspondence between 0% and 33% (low levels) across all stimulus sets. These groups were named correspondence training/no-repetition group (CT), correspondence training/repeat saying group (CT-RS), correspondence training/repeat numbers group (CT-RN), low control/repeat saying group (LC-RS), and low control/repeat numbers group (LC-RN). The other five groups exhibited baseline levels of correspondence between 67% and 100% (high levels) across all stimulus sets. These groups were named noncorrespondence training/no-repetition group (NCT), noncorrespondence training/repeat saying group (NCT-RS), noncorrespondence training/repeat numbers group (NCT-RN), high control/repeat saying group (HC-RS), and high control/repeat numbers group (HC-RN). Low and high levels of correspondence during baseline were deemed important to show large increases and decreases,

respectively, of correspondence levels during subsequent training conditions.

All groups differed with regard to the contingencies in place for verbal mediating responses during the period between saying and doing, the content of those mediating responses, and the contingencies in place for correspondence. For three of the five groups with low baseline levels of correspondence, the experimenter delivered reinforcers (feedback and tokens) following correspondence. For the CT group, the participant was not required to exhibit verbal mediating responses; for the CT-RS group, the participant was required to repeat what he or she had said in the say room continuously before playing with the toy; and for the CT-RN group, the participant was required to repeat a random sequence of numbers. For the remaining two low-baseline groups (control groups), there was no reinforcement contingency for correspondence. Members of the LC-RS group were required to repeat what was said (in the say room). Members of the LC-RN group were required to repeat random numbers.

For three of the five groups with high baseline levels of correspondence, reinforcers were contingent on noncorrespondence. For the NCT group, verbal mediating responses were not required. Before playing with the toy, participants in the NCT-RS group continuously repeated what they had said in the say room, and those in the NCT-RN group repeated random numbers. Control groups were exposed to the same verbalization requirements, but reinforcers were not delivered: In the HC-RS group, participants were required to repeat what they said in the say room, and in the HC-RN group, participants were required to repeat random numbers.

*Training.* This condition consisted of 12 trials that involved only Stimulus Set A. For the correspondence training groups (CT, CT-RS, CT-RN), the puppet asked, "Which one are you going to choose?" (regarding Stimulus Set

A). After the child verbally specified the toy, the experimenter escorted the child to the do room, which contained the toys described previously in Stimulus Set A (as well as some other toys), and the child was allowed to play for 2 min. Following this period, the child was taken back to the say room. Given correspondence, the experimenter said, "You said you were going to play with X, and you really did it. Because of that you will get a token," and the experimenter delivered a token. Given no correspondence, the experimenter said, "You said you were going to play with X; however, you played with Y [or X and Y, W, etc.]. Because of that you will not get a token. Try again!" The experimenter did not deliver tokens. For the CT-RS group, after leaving the say room, the experimenter instructed the participant to repeat what he or she said continuously until he or she entered the do room ("Repeat with me: 'I am going to play with X'"). For the CT-RN group, the experimenter instructed the child to repeat a specific sequence of numbers continuously ("Repeat with me: '2, 7, 35, 78, 49, 54, 10'"). If a participant did not comply with the experimenter's request after approximately 10 s, the experimenter said, "Come on! You have to continue repeating what I say; otherwise, we cannot play in the other room." Although it was necessary to prompt some of the children, all participants complied with the repetition requirement. For the CT group, there was no verbalization requirement when the child was taken to the do room.

Two control groups, LC-RS and LC-RN, were exposed to the same contingencies as those described for the CT-RS and CT-RN groups, respectively, except that the experimenter did not deliver feedback and tokens.

The noncorrespondence training groups (NCT, NCT-RS, NCT-RN) were exposed to the same conditions as the correspondence training groups (CT, CT-RS, CT-RN, respectively), except that reinforcers were dependent on noncorrespondence. Given noncorrespon-



dence, the experimenter said, "You said you were going to play with X; however, you played with Y [or X and Y, W, etc.]. Because of that you will get a token," and the experimenter delivered a token. Given correspondence, the feedback was "You said you were going to play with X, and you really did it. Because of that you will not get a token. Try again!" The experimenter did not deliver a token.

For the remaining two control groups, HC-RS and HC-RN, the contingencies were identical to those in place for the NCT-RS and NCT-RN groups, respectively; however, the experimenter did not deliver feedback or tokens.

*Generalization.* The contingencies in effect were the same for all groups and were similar to those in baseline to the extent that verbal mediating responses were not required, and the experimenter did not deliver feedback or tokens. However, this condition consisted of 12 trials, six for each stimulus set not used in the training conditions (B and C). The do room contained Stimulus Set B in the first six trials and Stimulus Set C in the final six trials. As occurred in the previous conditions, additional toys were also present in the do room during all trials.

After generalization, children exposed to non-correspondence training (NCT, NCT-RS and NCT-RN groups) were exposed to 12 trials of correspondence training with Stimulus Set A in order to reestablish high levels of correspondence. These data were not included in the analysis.

*Interobserver agreement.* Interobserver agreement was assessed by having a second observer score the dependent variables from video. Interobserver agreement was calculated by dividing the number of agreements (i.e., both observers scored the same response) by the number of agreements plus disagreements (i.e., observers scored different responses), and converting the quotient to a percentage. We assessed interobserver agreement on 100% of trials, and the mean was 100% for all evaluated events and for each child across all conditions.

## RESULTS

Figures 1 and 2 depict trial-by-trial correspondence for each child from all groups across all conditions. The word "yes" and the filled triangles indicate correspondence; the word "no" and the open circles indicate the absence of correspondence. Stimulus Sets A, B, and C are displayed, respectively, on the top, middle, and bottom sections of each panel.

Figure 1 shows results obtained with the CT, CT-RS, CT-RN, LC-RS, and LC-RN groups. During baseline, all children showed correspondence in no more than one of three trials for each stimulus set, as required (recall that we grouped members based on either low or high baseline correspondence). During reinforcement for correspondence (training), correspondence was more frequent for participants who were required to repeat their own verbalizations at the beginning of a trial (CT-RS group) than for those who were not required to repeat their verbalizations (CT group) or were required to repeat numbers (CT-RN group). More specifically, correspondence was observed in at least 10 of 12 trials for the CT-RS group and in no more than 6 or 7 of 12 trials for the CT-RN and CT groups, respectively. In the absence of reinforcement, participants in the LC-RS and LC-RN groups showed the lowest frequency of correspondence; that is, correspondence occurred in no more than 4 of 12 trials, regardless of whether participants were required to repeat their own verbalizations or random numbers.

During generalization, the highest occurrence of correspondence (at least five of six trials for both stimulus sets) was observed when participants had to repeat their own verbalizations (CT-RS group), and the lowest (no more than two of six trials for both stimulus sets) when participants had to repeat random numbers (CT-RN group) in the previous condition. Participants who were not required to emit verbal mediating responses (CT group) previously exhibited intermediate correspondence (between zero and five of six trials). For

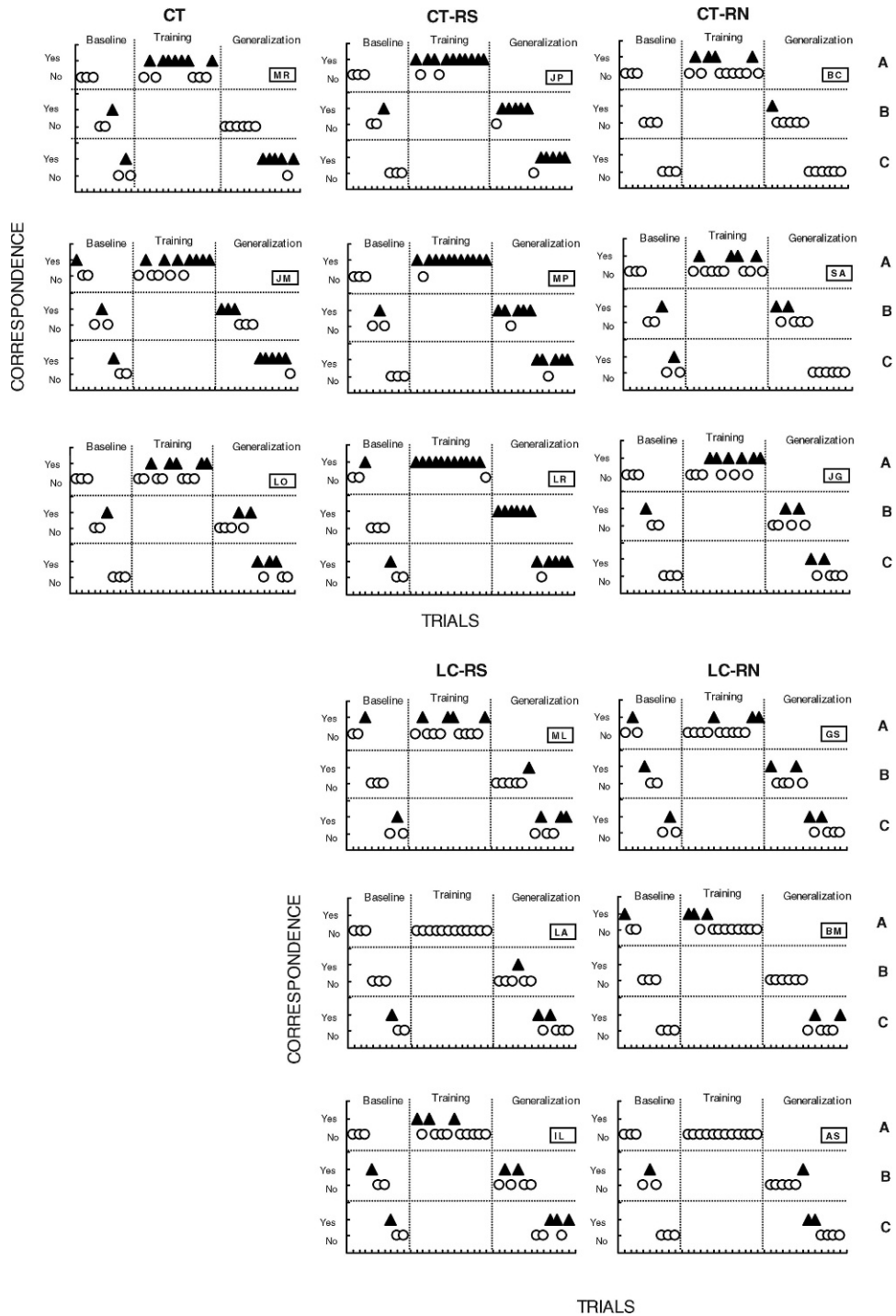


Figure 1. Occurrence or absence of correspondence during baseline, training, and generalization for each participant of the CT, CT-RS, CT-RN, LC-RS, and LC-RN groups. The word “yes” and the filled triangles on the *y* axis indicate occurrence of correspondence. The word “no” and the open circles indicate lack of correspondence. A, B, and C represent Stimulus Sets A, B, and C, respectively.

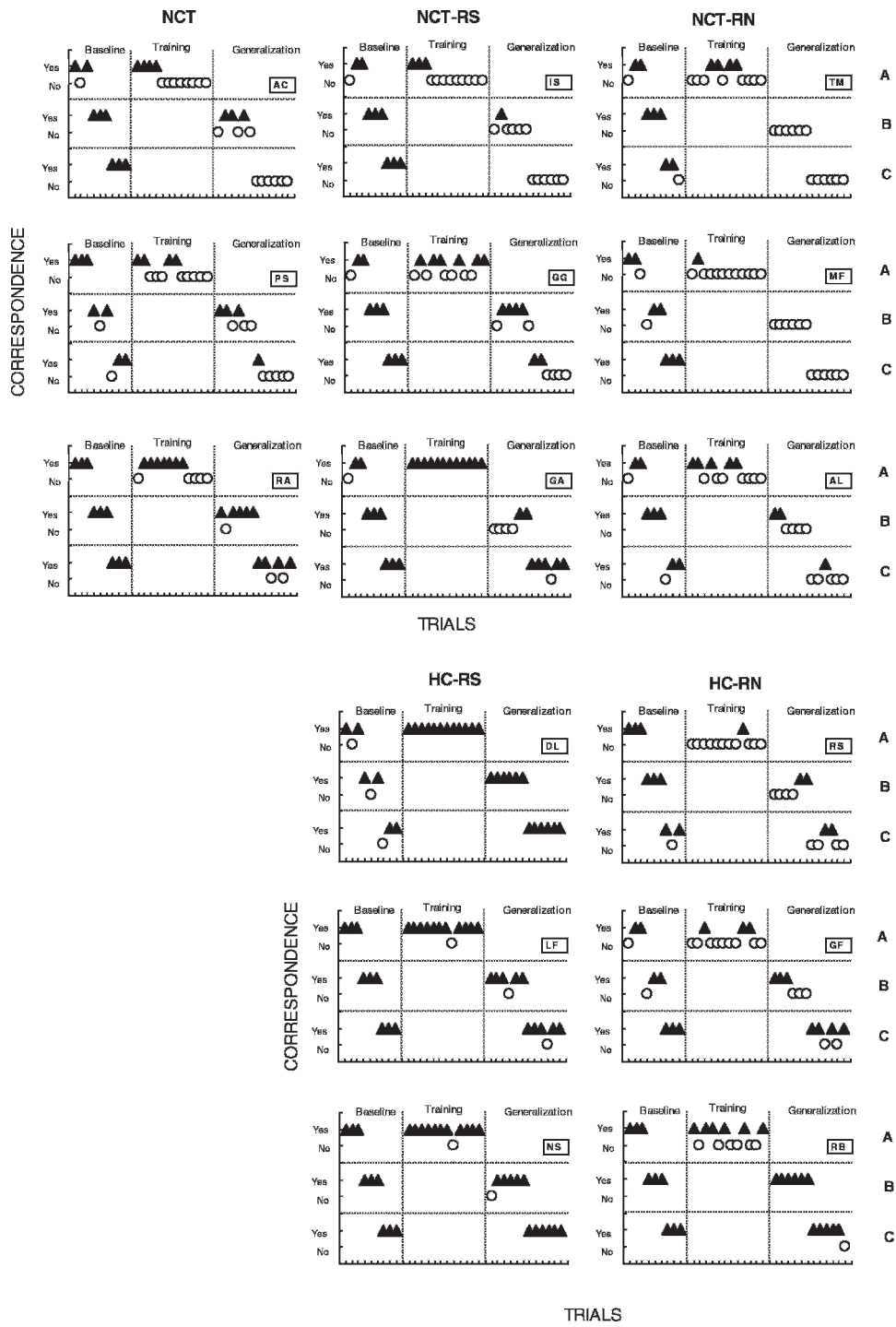


Figure 2. Occurrence or absence of correspondence during baseline, training, and generalization for each participant of the NCT, NCT-RS, NCT-RN, HC-RS, and HC-RN groups. The word “yes” and the filled triangles on the y axis indicate occurrence of correspondence. The word “no” and the open circles indicate lack of correspondence. A, B, and C represent Stimulus Sets A, B, and C, respectively.



participants in the LC-RS and LC-RN groups, the occurrence of correspondence was comparable to that of the CT-RN group (no more than three of six trials), regardless of the content of the verbalizations emitted in the earlier condition.

Figure 2 shows the results of the NCT, NCT-RS, NCT-RN, HC-RS, and HC-RN groups. During baseline, all participants showed noncorrespondence in no more than one of three trials for each stimulus set. During reinforcement for noncorrespondence (training), noncorrespondence was more frequent when participants repeated random numbers (NCT-RN group) than when verbal mediating responses were not required (NCT group). For the former group, noncorrespondence occurred in 7 to 11 of 12 trials, and for the latter group, it occurred in five to eight trials. For participants who had to repeat their own verbalizations (NCT-RS group), there was greater variation in the frequency of noncorrespondence among participants. For instance, noncorrespondence was observed in 9 of 12 trials for Participant IS, but it was never observed for Participant GA. In the absence of reinforcement, noncorrespondence was rarely observed for participants of the HC-RS group, but it was highly frequent for participants of the HC-RN group. That is, we observed noncorrespondence in no more than 1 of 12 trials when participants repeated their own verbalizations and in at least 6 of 12 trials when participants repeated numbers.

During generalization, noncorrespondence was observed again mostly for participants who had to repeat random numbers in the previous condition (NCT-RN group). In fact, two participants in this group engaged in noncorrespondence in all trials of each stimulus set. Participants who were not required to emit verbalizations and those who had to repeat their own verbalizations during the training condition (NCT and NCT-RS groups, respectively) showed greater variation in the frequency of

noncorrespondence: for some participants, noncorrespondence occurred in only one of six trials, whereas for others, it occurred in all trials. For participants who had not been exposed to reinforcement for noncorrespondence previously, generalization was greater for those who were required to repeat numbers (HC-RN group) than for those who had to repeat their own verbalizations (HC-RS group). For this last group, none of the participants engaged in noncorrespondence in more than one of six trials.

Figure 3 shows increases (values above zero) and decreases (values below zero) of the percentage of correspondence (two top panels) and noncorrespondence (two bottom panels) across conditions for each group. Two analyses were performed: changes in correspondence (or noncorrespondence) for Stimulus Set A during the training condition compared to baseline and for Stimulus Sets B and C during the generalization condition compared to baseline. For the analysis of changes in correspondence from baseline to training, the occurrence of correspondence for Stimulus Set A was divided by the total number of trials with this stimulus set in each condition, and the ratio was converted to a percentage. Next, the percentage of correspondence during training was subtracted from the percentage of correspondence during baseline. For instance, for all participants of the CT group, there was one occurrence of correspondence in a total of nine trials during baseline, and there were 19 occurrences of correspondence in a total of 36 trials during training. Thus, the percentage of correspondence was 11.1% in baseline and 52.8% in training. The difference between those percentages (41.7%) indicates an increase in correspondence from baseline to training. For the analysis of changes in correspondence from baseline to generalization, the occurrence of correspondence for both Stimulus Sets B and C were divided by the total number of trials with these stimulus sets in each condition (18

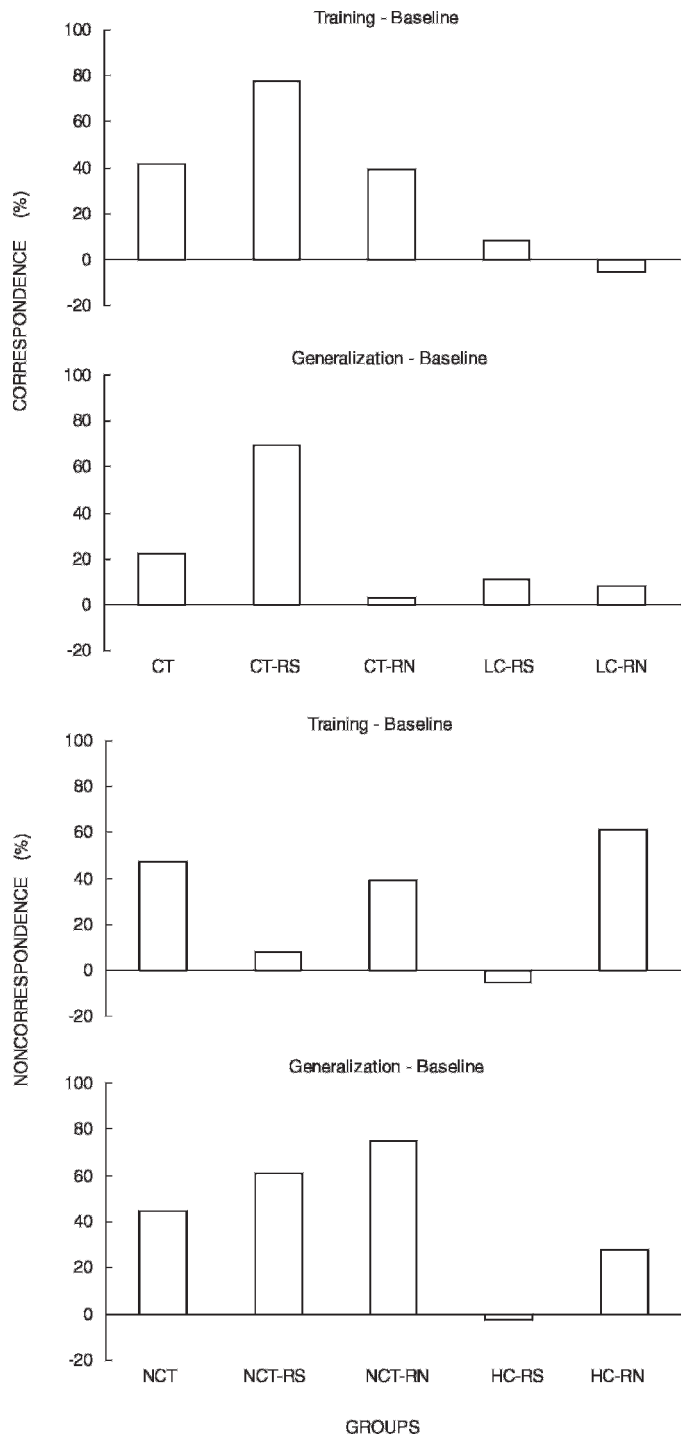


Figure 3. Increases (values above zero) and decreases (values below zero) in correspondence (two top panels) and noncorrespondence (two bottom panels) levels across conditions for each group. See text for details.

trials in baseline and 36 trials in generalization), and the quotient was converted to a percentage. Subsequently, the percentage of correspondence during generalization was subtracted from the percentage of correspondence during baseline. The same steps were taken to analyze changes in noncorrespondence from baseline to training and from baseline to generalization.

With regard to correspondence, in the presence of reinforcement, repetition of verbalizations (CT-RS group) produced a greater increase in correspondence during training than repetition of random numbers (CT-RN group) or the absence of verbal mediating responses (CT group). In the absence of reinforcement (LC-RS and LC-RN groups), there were only minor changes in correspondence from baseline to training in spite of the content of the verbal mediating response. When generalization is compared to baseline, the increase in correspondence was greater for the CT-RS group, smaller for the CT-RN group, and intermediate for the CT group. For the control groups, increases in correspondence were marginal.

With respect to noncorrespondence, the absence of verbalizations (NCT group) and the repetition of numbers (NCT-RN and HC-RN groups) generated greater increases in noncorrespondence from baseline to training than the repetition of verbalizations (NCT-RS and HC-RS), despite of the presence or absence of reinforcement. The comparison between generalization and baseline shows that noncorrespondence increased more for the groups previously exposed to reinforcement, especially for the NCT-RN group, and less for the control groups, mainly for the HC-RS group.

## DISCUSSION

Correspondence-dependent reinforcement promoted the acquisition and generalization of correspondence to a higher extent for participants who had to verbalize what was said (CT-RS group) and to a lower extent for participants who had to verbalize random numbers (CT-RN

group). Conversely, noncorrespondence-dependent reinforcement favored acquisition and generalization of noncorrespondence mainly for participants who had to verbalize random numbers (NCT-RN group) compared to those who had to verbalize what was said (NCT-RS group). When verbal mediating responses were not required (CT and NCT groups), acquisition and generalization of correspondence and noncorrespondence tended to be similar to those obtained with verbalization of random numbers.

With correspondence-dependent reinforcement (CT, CT-RS, and CT-RN groups), correspondence increased; with no reinforcement (LC-RS and LC-RN groups), baseline levels of correspondence were maintained. This result confirms those reported by Lattal and Doepke (2001) and Ward and Stare (1990), among others. For instance, in the study by Lattal and Doepke, when experimenters reinforced correspondence, levels of correspondence increased to 100%. In a subsequent condition, in which reinforcement for correspondence was withdrawn, levels of correspondence decreased to 40%. In addition, in the present study, the effects of reinforcement for correspondence appear to have been moderated by the content of the verbal mediating responses. With task-related responses, acquisition and generalization were greater than with task-unrelated responses. These results are consistent with those obtained by Taylor and O'Reilly (1997; see also Meichenbaum & Goodman, 1971). Taylor and O'Reilly found that acquisition of shopping skills was facilitated or disrupted by task-related and task-unrelated verbalizations, respectively. The present study expands their findings to the extent that it shows that the disruptive effect of task-unrelated verbalizations occurs in situations in which correspondence is trained directly.

The present results also extend those reported by Luciano et al. (2001). The study by Luciano et al. involved correspondence training, but unlike the procedures described by Taylor and O'Reilly (1997) and those in the present study,

only task-related stimuli were involved. Carrying these stimuli (stickers) between what was said and the nonverbal behavior promoted higher levels of generalization than when they were not carried. According to the authors, this effect occurred because the continuous presence of the sticker allowed the participants to consult it whenever they wanted. In terms of generalization, however, the role of the stickers was not clear. Results for the CT-RS and CT-RN groups in the present study help to clarify this question. Although verbalizations occurred continuously, repetition of what was said promoted correspondence, and repetition of random numbers had a detrimental effect on correspondence. Thus, it can be suggested that the most relevant variable in the study by Luciano et al. was the similarity between the sticker's content and the doing. It follows that consulting task-unrelated stickers would not contribute to correspondence generalization.

Interestingly, the levels of correspondence acquisition obtained in the absence of verbal mediating responses were comparable to those observed with repetition of random numbers. It is possible that in the absence of overt verbalization requirements, other stimuli (e.g., the experimenter, toys unrelated to what was said) may have evoked covert verbal behavior that interfered with control by what was said. This may explain why correspondence training sometimes does not generate high levels of correspondence. For instance, in the study conducted by Israel and O'Leary (1973), reinforcement produced correspondence in about 50% of the trials (see also Baer et al., 1988; Israel, 1973). Another possibility of control by distracting stimuli is suggested by the generalization data: As observed during training, correspondence levels for the CT group were closer to those shown by the CT-RN group than by the CT-RS group.

Reinforcement for noncorrespondence in the absence of verbal mediating responses generated acquisition and generalization of noncorrespon-

dence (NCT group), a result that replicates those reported by Amorim and Andery (2002). A similar effect was obtained with task-unrelated verbalizations (NCT-RN group), but not when verbalizations were task related (NCT-RS group). The similarity between the NCT and NCT-RN groups suggests that when verbalizations were not required, task-unrelated covert behavior may have interfered with control by what was said. Noncorrespondence was weaker for the NCT-RS group during the training condition probably because this group presented high levels of correspondence during baseline. Consequently, the repetition of what was said contributed to an increased probability of the correspondent nonverbal behavior, thus competing with reinforcement for noncorrespondence. Although training did not promote noncorrespondence, the effect of noncorrespondence training was observed during the generalization condition. That is, when what was said was no longer required, noncorrespondence was observed despite the absence of reinforcement.

In the absence of reinforcement for correspondence or noncorrespondence, the effects of the content of mediating responses depended on baseline correspondence levels. With low baseline levels of correspondence, repetition of what the child said was not enough to promote correspondence, and repetition of random numbers was associated with noncorrespondence. Conversely, with high baseline levels of correspondence, repetition of random numbers decreased correspondence, and repetition of what the child said maintained correspondence.

Taken together, the effects of mediating responses may be interpreted based on the functional role of saying. For example, because reinforcers are arranged for say-do correspondence, the content of what is said may function as a discriminative stimulus (e.g., Guevremont, Osnes & Stokes, 1986), that is, as a stimulus that evokes a response due to a history of differential reinforcement in the presence of such stimuli (Michael, 1982). Based on such a

conceptualization, correspondence would be expected when what is said is continuously repeated but not when numbers are repeated, because this latter requirement would weaken the evocative function of what was said. These effects were observed even when there was no reinforcement for correspondence or noncorrespondence (control groups). The absence of correspondence during baseline (LC-RS and LC-RN groups) suggests, among other things, that what is said, by itself, did not have evocative control over subsequent nonverbal behavior. During training, because reinforcers were not delivered for say-do correspondence, discriminative control by saying was not established. As a result, repetition of what was said was not expected to evoke the corresponding doing. On the other hand, the occurrence of correspondence during baseline (HC-RS and HC-RN groups) implies evoking functions of what is said. When repeating random numbers was required, it disrupted the discriminative control by what was said, thus decreasing correspondence. In sum, the present data demonstrated that responding between saying and doing will enhance (or weaken) discrimination, depending on its similarities with initial verbal behavior regarding future nonverbal behavior (see Kramer, 1982, Experiment 3, for further evidence).

Conclusions based on the present study must be tentative and should consider some procedural limitations. First, the criterion for changing conditions was based on the number of trials. This criterion was chosen because during a pilot study in which the criterion was based on responding, several participants got bored and abandoned the experiment. The criterion based on a fixed number of trials may have precluded the establishment of a more effective control by the reinforcement contingencies, thus generating variability among participants. Second, due to the difficulty in recruiting and selecting participants, only three children were studied per group, restricting generalization of the conclusions. The use of a single-subject design

(involving repeated measurement, as in the current study) would address this limitation, but it would extend the duration of the experiment substantially. Third, it has been demonstrated that corrective feedback has discriminative and reinforcing functions (e.g., Luczynski & Hanley, 2009; Ribes & Rodriguez, 2001). In the present study, the role of feedback on correspondence and noncorrespondence training was not isolated because it was always presented with tokens. Thus, results of the current study do not permit one to disentangle the role of feedback from the contingency arranged for correspondence (or noncorrespondence). As noted by Lattal and Doepke (2001), corrective feedback may facilitate correspondence (or noncorrespondence), and future research should be designed to focus more attention on the role of feedback alone.

In spite of these limitations, the present findings suggest that the occurrence of correspondence encompasses more than the reinforcement of correspondence. That is, verbalizations emitted between saying and doing must be taken into account, given that they may interact with reinforcement contingencies in producing or preventing correspondence.

## REFERENCES

- Amorim, C., & Andery, M. A. (2002). Quando esperar (ou não) pela correspondência entre comportamento verbal e comportamento não verbal [When waiting (or not) for correspondence between verbal and nonverbal behaviors]. In H. J. Guilhardi, M. B. B. P. Madi, P. P. Queiroz, & M. C. Scoz (Organizers), *Sobre comportamento e cognição: contribuições para a construção da teoria do comportamento* (pp. 37–48). Santo André, Brazil: ESETec.
- Baer, R. A. (1990). Correspondence training: Review and current issues. *Research in Developmental Disabilities*, 11, 379–393.
- Baer, R. A., Detrich, R., & Weninger, J. M. (1988). On the functional role of verbalization in correspondence training procedures. *Journal of Applied Behavior Analysis*, 21, 345–356.
- Baer, R. A., Williams, J. A., Osnes, P. G., & Stokes, T. F. (1984). Delayed reinforcement as an indiscriminable contingency in verbal/nonverbal correspondence training. *Journal of Applied Behavior Analysis*, 17, 429–440.



- Beckert, M. E. (2005). Correspondência verbal-não verbal: Pesquisa básica e aplicações na clínica. [Verbal/nonverbal correspondence: Basic research and clinical applications]. In J. Abreu-Rodrigues & M. R. Ribeiro (Organizers), *Análise do comportamento: Pesquisa, teoria e aplicação* (pp. 229–244). Porto Alegre, Brazil: Artmed.
- Bevill-Davis, A., Clees, T., & Gast, D. L. (2004). Correspondence training: A review of the literature. *Journal of Early and Intensive Behavior Intervention*, 1, 14–27.
- de Freitas Ribeiro, A. F. (1989). Correspondence in children's self-report: Tacting and manding aspects. *Journal of the Experimental Analysis of Behavior*, 51, 361–367.
- Guevremont, D. C., Osnes, P. G., & Stokes, T. F. (1986). Preparation for effective self-regulation: The development of generalized verbal control. *Journal of Applied Behavior Analysis*, 19, 99–104.
- Israel, A. C. (1973). Developing correspondence between verbal and nonverbal behavior: Switching sequences. *Psychological Reports*, 32, 1111–1117.
- Israel, A. C., & O'Leary, K. D. (1973). Developing correspondence between children's words and deeds. *Child Development*, 44, 575–581.
- Karoly, P., & Dirks, M. J. (1977). Developing self-control in preschool children through correspondence training. *Behavior Therapy*, 8, 398–405.
- Kramer, S. P. (1982). Memory for recent behavior in the pigeon. *Journal of the Experimental Analysis of Behavior*, 38, 71–85.
- Lattal, K. A., & Doepke, K. J. (2001). Correspondence as conditional stimulus control: Insights from experiments with pigeons. *Journal of Applied Behavior Analysis*, 34, 127–144.
- Lloyd, K. E. (2002). A review of correspondence training: Suggestions for revival. *The Behavior Analyst*, 25, 57–73.
- Luciano, M. C., Herruzo, J., & Barnes-Holmes, D. (2001). Generalization of say-do correspondence. *The Psychological Record*, 51, 111–130.
- Luczynski, K. C., & Hanley, G. P. (2009). Do children prefer contingencies? An evaluation of the efficacy of and preference for contingent versus noncontingent social reinforcement during play. *Journal of Applied Behavior Analysis*, 42, 511–525.
- Meichenbaum, D. H., & Goodman, J. (1971). Training impulsive children to talk to themselves: A means of developing self-control. *Journal of Abnormal Psychology*, 77, 115–126.
- Michael, J. (1982). Distinguishing between discriminative and motivational functions of stimuli. *Journal of the Experimental Analysis of Behavior*, 37, 149–155.
- Paniagua, F. A. (1990). A procedural analysis of correspondence training techniques. *The Behavior Analyst*, 13, 107–119.
- Paniagua, F. A., & Baer, D. M. (1982). The analysis of correspondence training as a chain reinforceable at any point. *Child Development*, 53, 786–798.
- Ribes, E., & Rodriguez, M. E. (2001). Correspondence between instructions, performance, and self-descriptions in a conditional discrimination task: The effects of feedback and type of matching response. *The Psychological Record*, 51, 309–333.
- Risley, T. R., & Hart, B. (1968). Developing correspondence between nonverbal and verbal behavior of preschool children. *Journal of Applied Behavior Analysis*, 11, 267–281.
- Taylor, I., & O'Reilly, M. F. (1997). Toward a functional analysis of private verbal self-regulation. *Journal of Applied Behavior Analysis*, 30, 43–58.
- Ward, W. D., & Stare, S. W. (1990). The role of subject verbalization in generalized correspondence. *Journal of Applied Behavior Analysis*, 23, 129–136.

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